

# (12) UK Patent Application (19) GB (11) 2 382 864 (13) A

(43) Date of A Publication 11.06.2003

(21) Application No 0129107.9

(22) Date of Filing 05.12.2001

(71) Applicant(s)  
Autoliv Development AB  
(Incorporated in Sweden)  
Patent Department Sweden,  
S-447 83 Vargarda, Sweden

(72) Inventor(s)  
Frédéric Tarte

(74) Agent and/or Address for Service  
Forrester Ketley & Co  
Forrester House, 52 Bounds Green Road,  
LONDON, N11 2EY, United Kingdom

(51) INT CL<sup>7</sup>  
B62D 1/06 // F28D 15/02

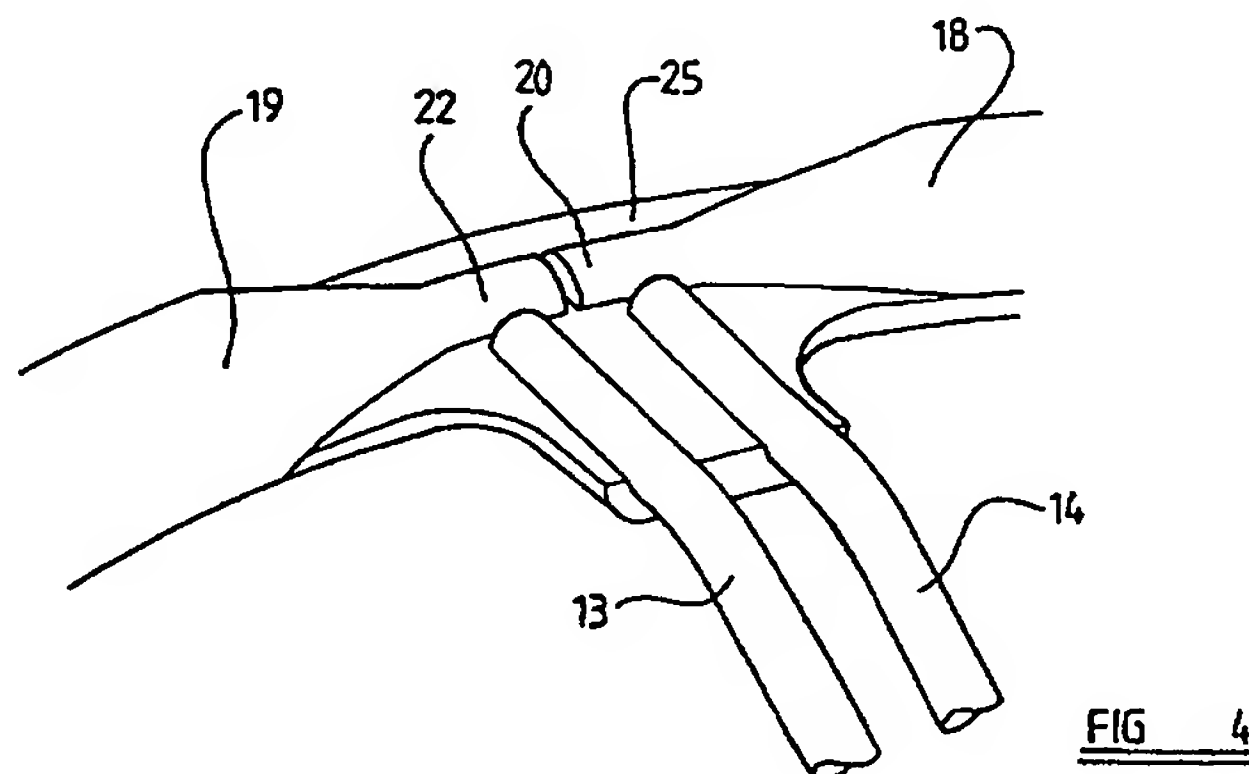
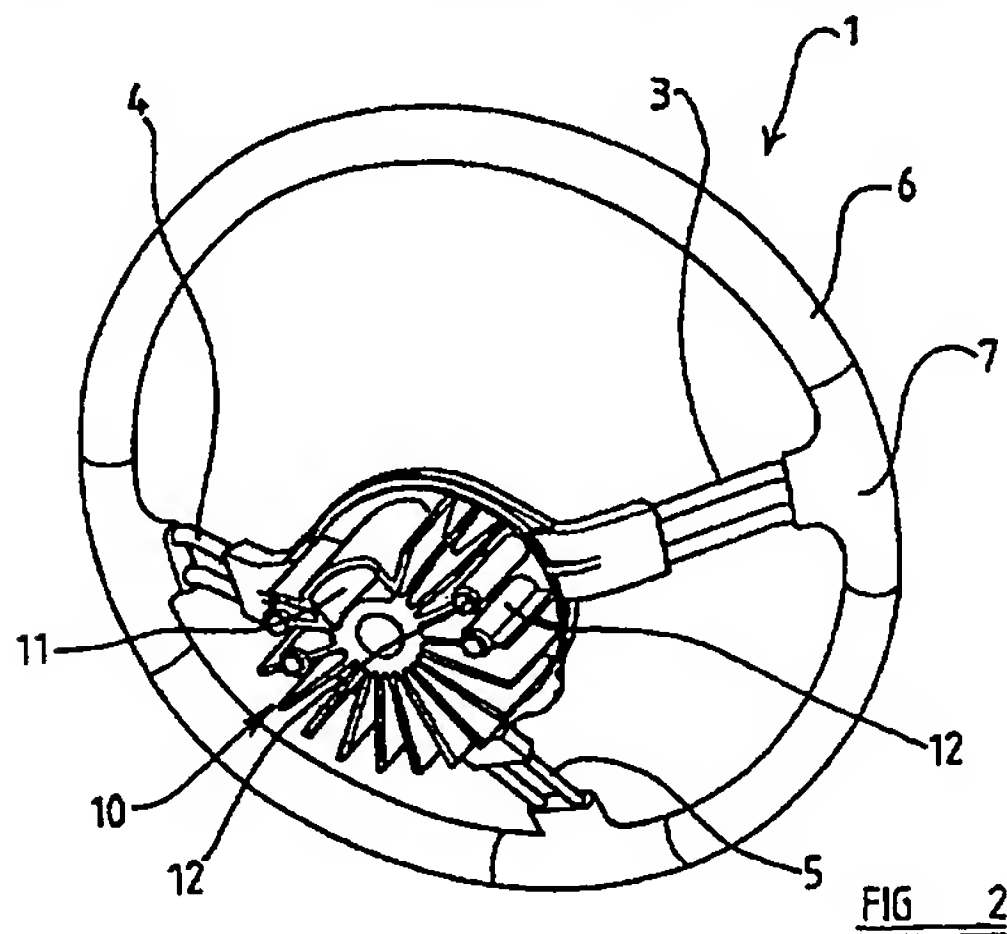
(52) UK CL (Edition V )  
F2Y Y3102  
F4U U25A  
U1S S1820

(56) Documents Cited  
DE 019951224 A JP 620157859 A  
JP 560091189 A JP 100230857 A  
US 5850741 A US 4640340 A  
US 4204246 A

(58) Field of Search  
UK CL (Edition T ) F2Y YSX Y3102, F4U U25B  
INT CL<sup>7</sup> B62D 1/06, F28D 15/02  
Other: ONLINE: WPI, EPODOC, JAPIO, INTERNET,  
FULL-TEXT

(54) Abstract Title  
**STEERING WHEEL WITH HEAT EXCHANGER AND HEAT-PIPES**

(57) A steering wheel(1) that has a hub (2, Fig. 1) which incorporates a heat exchanger element (10) which is connected by spokes (3,4,5) to a rim (6). The heat exchanger (10) may be heated or cooled and is connected by means of heat-pipes (13-16, Fig.3) in the spokes (3,4) to further heat-pipes (20, 22, Fig.3) extending substantially around the whole rim. The rim may be heated or cooled rapidly this way. The spokes (3,4) may comprise two substantially parallel heat-pipes(13,14), and there may be two heat-pipes (18,19) within the rim, each extending substantially half-way round the rim. The heat-pipes (18,19) in the rim may be connected to those (e.g. 13,14) in the spoke(s) by means of thermal contact block(s) (25). The heat exchanger may have plurality of fins to dissipate heat and a recess (11) to hold an electric heater.



GB 2 382 864 /

1 / 2

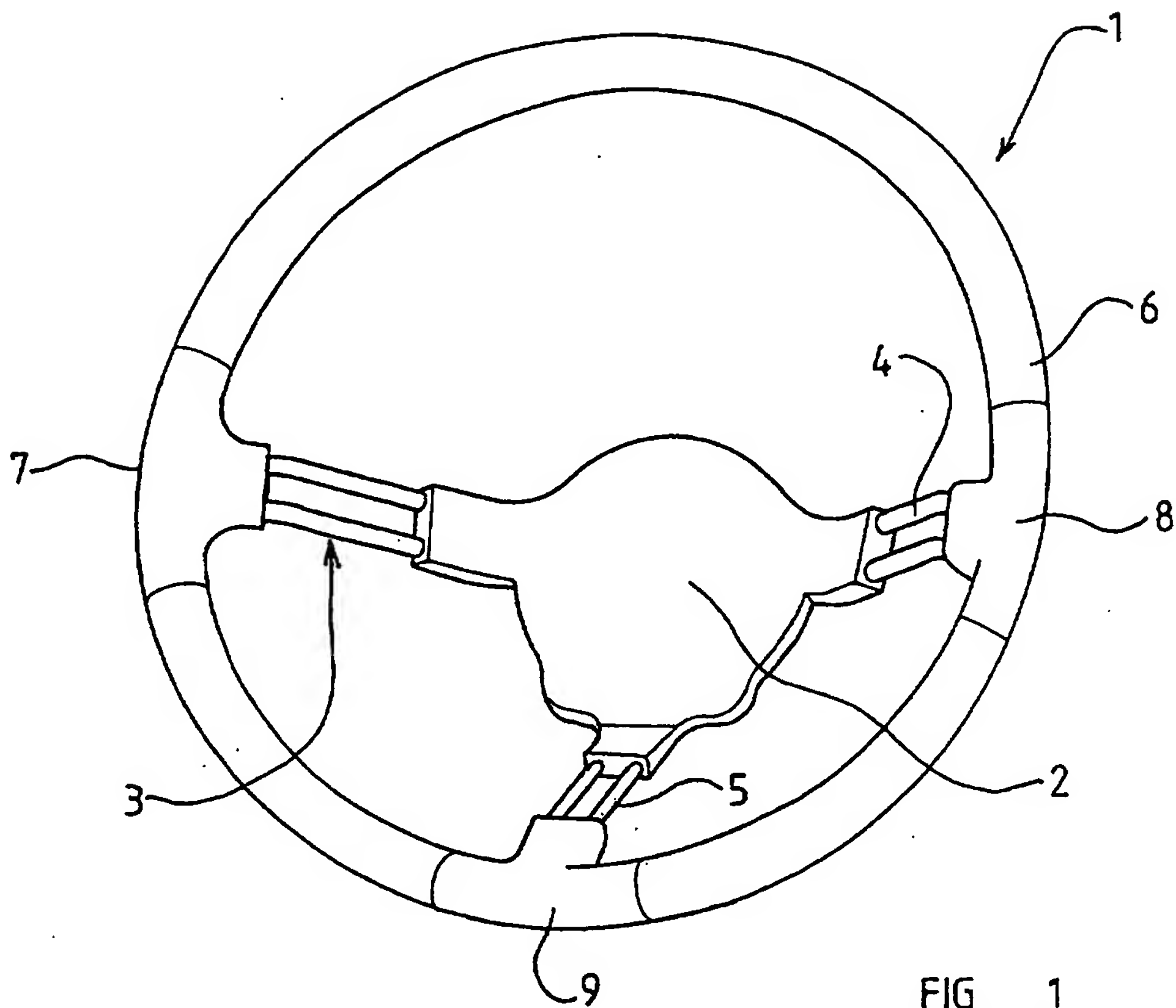


FIG 1

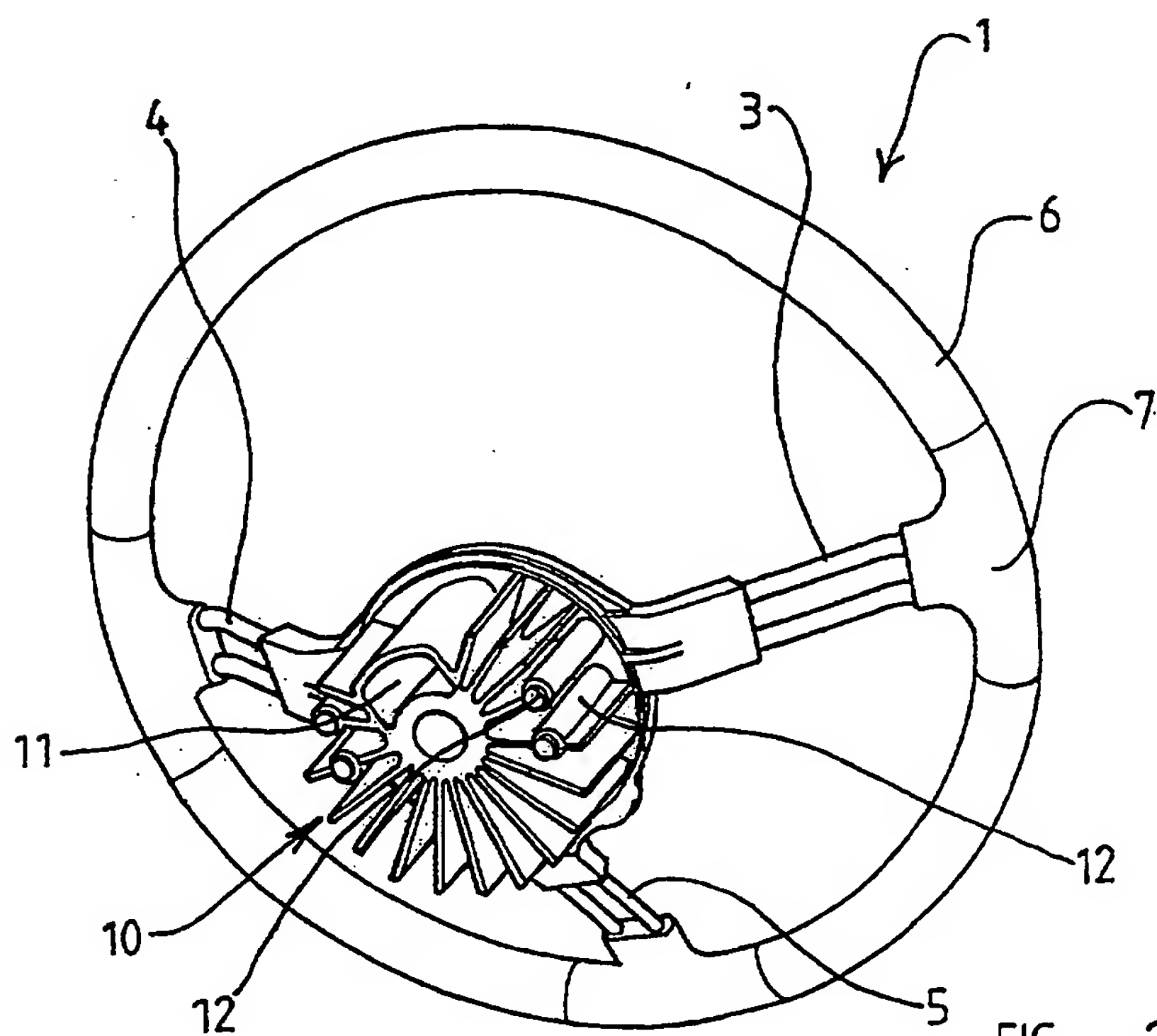
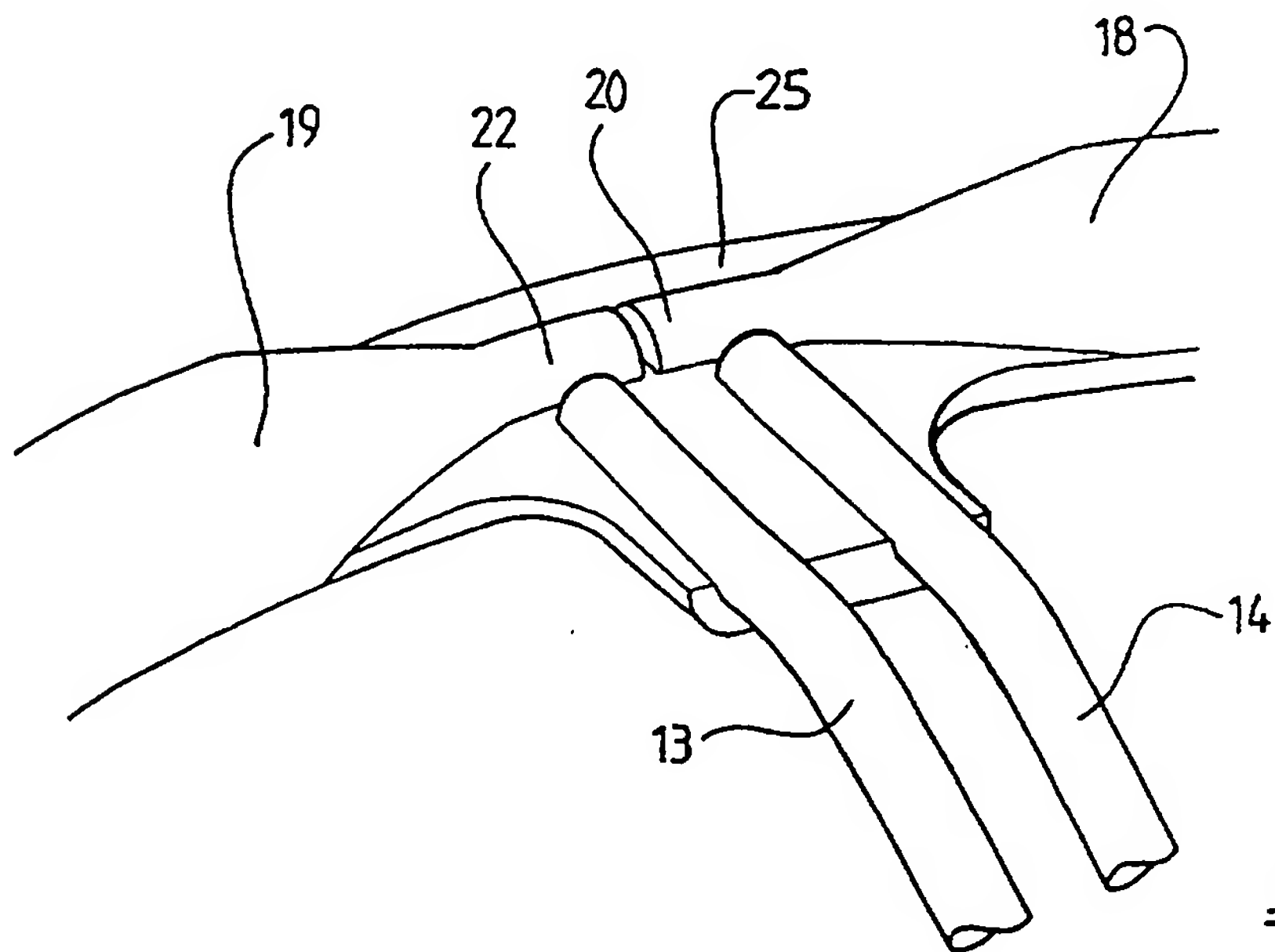
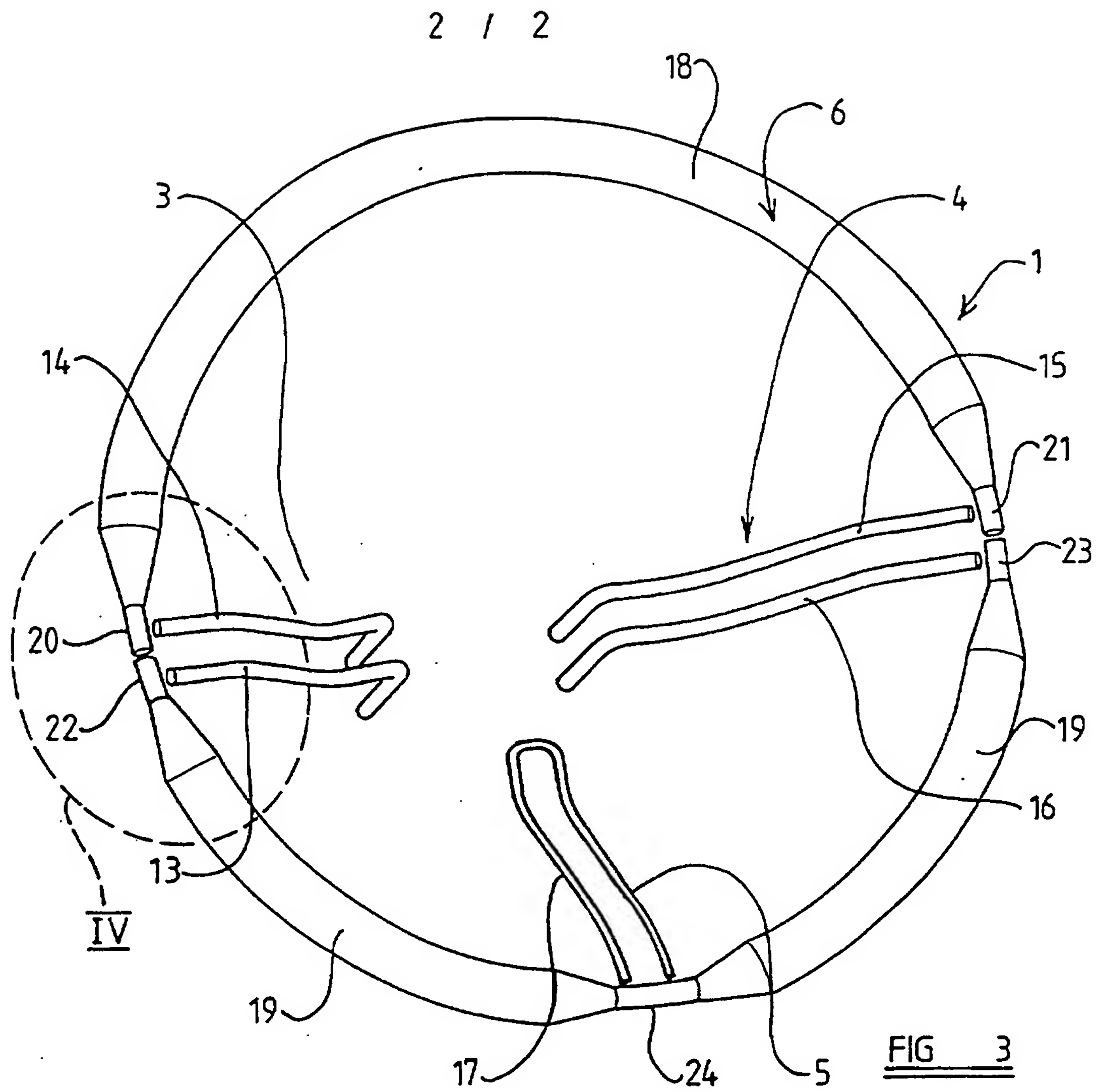


FIG 2



DESCRIPTION OF INVENTION

**“IMPROVEMENTS IN OR RELATING TO A STEERING WHEEL”**

**THE PRESENT INVENTION** relates to a steering wheel, and more particularly relates to a steering wheel for a motor vehicle, such as a motor car.

In many countries, during at least the summer months of the year, the steering wheel of a car which is parked outdoors may become extremely hot. A hot steering wheel is difficult to hold, and it is therefore dangerous to drive whilst the steering wheel is hot. A corresponding problem may be found in cold climates where it is equally dangerous to drive a motor vehicle with a very cold steering wheel.

It can take rather a long time for the temperature of the steering wheel to be changed substantially by use of the heating or air-conditioning system normally provided within a motor vehicle. It has been proposed to provide a steering wheel with electric heating wires, and these may be used to heat a cold steering wheel but cannot be used satisfactorily to cool a hot steering wheel.

The present invention seeks to provide an improved steering wheel.

According to one aspect of this invention there is provided a steering wheel, the steering wheel comprising a central hub connected by at least one spoke to a rim, the hub containing a heat exchanger element, the heat exchanger element being adapted to be heated and to be cooled, there being at least one heat pipe extending, as part of a spoke, from the heat exchanger to the rim of the steering wheel, there being at least one further heat pipe present within the rim in thermal contact with the heat pipe present in the spoke.

According to a second aspect of this invention there is provided a steering wheel having a hub connected by a spoke to a rim, there being a heat exchanger within the hub adapted to be heated and cooled, the heat exchanger being connected to a heat pipe arrangement which extends from the hub to the rim through at least one spoke, and which extends substantially entirely around the rim of the steering wheel.

Conveniently the heat pipe arrangement comprises a first heat pipe present in at least one spoke, and at least one further heat pipe present in the rim.

Preferably there are a plurality of spokes which incorporate heat pipes.

Conveniently the steering wheel has a plurality of spokes which each comprise two substantially parallel heat pipes.

Preferably two heat pipes are provided within the rim, each heat pipe extending substantially half-way round the rim.

Conveniently the or each heat pipe in a spoke is connected to at least one heat pipe in the rim by means of a thermal contact block formed of a material of high thermal conductivity.

Advantageously the heat exchanger is provided with a recess to receive an electric heater.

Conveniently the heat exchanger is provided with a plurality of fins to dissipate heat.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a front view of a steering wheel in accordance with the invention,

FIGURE 2 is a rear view of the steering wheel of Figure 1,

FIGURE 3 is a view of some components of the steering wheel of Figure 1, with other components being omitted for the sake of explanation, and

FIGURE 4 is a diagrammatic enlarged view of part of a steering wheel in accordance with the invention, again with parts omitted for the sake of clarity of illustration.

It is to be appreciated that in the present invention use is made of "heat pipes". Heat pipes have been proposed before and are elongate pipes which can

be used to facilitate the rapid transfer of heat. A typical heat pipe comprises an elongate tube formed of metal such as aluminium or copper. The interior of the tube contains an elongate wick which extends from one end of the tube to the other. The wick may be mounted on the inner wall of the pipe. The pipe contains a quantity of a volatile fluid such as water, acetone or methanol. The pipe is maintained with an internal pressure which is substantially below atmospheric pressure. If one end region of the pipe is heated, the liquid within the pipe will vaporise within that region and will then move, in the gaseous phase, towards the other end of the pipe. As the vapour become cooled, the vapour will condense. The vapour will again turn into liquid, and the liquid will be transported by gravity and/or by a wicking action provided by the wick back to the heated end of the pipe. It is to be appreciated that heat will be absorbed, due to the latent heat of vaporisation, at the heated end of the pipe, and heat will be emitted, due to the reclamation of the heat of vaporisation as the vapour condenses, at the point in the heat pipe at which the vapour condenses. Heat can be very quickly transported from one end of a heat pipe to the other with very little loss of heat during transport. Heat pipes of this type have been proposed previously and are known to the man skilled in the art.

Figure 1 illustrates a steering wheel 1 in accordance with the invention. The steering wheel includes a hub 2 which is connected by three generally radially extending spokes 3, 4, 5 to a rim 6. The spokes are each connected to the rim by a respective connector 7, 8, 9.

As can be seen from Figure 2, the underside of the hub 2 is provided with a heat exchanger block 10 formed of an appropriate metal casting, the heat exchanger block having a plurality of heat dissipating fins. The heat exchanger block additionally comprises a cavity 11 adapted to receive an electrically



operated heater. The heat exchanger also defines bores 12 to receive the end parts of heat pipes.

Alternatively the cavity 11 may receive part of a heat pump arrangement which can pump thermal energy into or away from the heat exchanger block 10.

Referring now to Figure 3, the spoke 3 is constituted by two parallel heat pipes 13, 14 and the spoke 4 is constituted by two parallel heat pipes 15, 16. The radially inner-most ends of the heat pipes are cranked to be received within the bores 12 to be in thermal contact with the heat exchanger block 10. The spoke 5 is simply constituted by a “U”-shaped wire 17.

The core of the rim 6 of the steering wheel 1 is constituted by two heat pipes, firstly a heat pipe 18 which extends from the radially outer end of the spoke 3 to the radially outer end of the spoke 4 and secondly, a heat pipe 19 which extends from the radially outer end of the spoke 3, past the end of the spoke 5, to the radially outer end of the spoke 4. The combination of the two heat pipes 18, 19 extends all of the way around the rim 6 of the steering wheel.

The heat pipe 18 is provided with opposed ends 20, 21 which are of relatively narrow diameter. The heat pipe 19 is also provided with opposed ends 22, 23 of relatively narrow diameter, and the heat pipe 19 is provided with a central “waisted” region 24 of relatively narrow diameter. The heat pipe 19 may be divided into two separate heat pipes at this point, with the central “waisted” region preventing communication between the two halves of the heat pipe 19.

As can be seen in Figure 4, the connector 7 incorporates a metal casting 25, formed of aluminium or copper, which receives the ends of the heat



pipe 13, 14, and which also receives the narrow diameter ends 20, 22 of the heat pipes 18, 19. A similar casting, which is a mirror image to the casting 25, is sandwiched together with the casting 25 within the connection 7, thus ensuring that the described components are firmly held together and are all in excellent thermal contact with each other.

It is to be appreciated that if the rim of the steering wheel is cold, an electric heater within the recess 11 may be operated, thus heating the heat exchanger block 10. Heat will rapidly be transferred by the conductive metal forming the heat exchanger to the bores 12, and thus to the deflected ends of the heat pipes 13, 14, 15, 16. Heat will rapidly be transmitted by these heat pipes to the castings 25 where the heat is transmitted to the ends of the heat pipes 18 and 19. Heat will thus rapidly be transmitted around the entire rim of the steering wheel.

If the rim of the steering wheel is hot, cooling air may be blown past the fins of the heat exchanger block 10, thus cooling the heat exchanger block. Thus the ends of the heat pipes 13, 14, 15, 16 received within the bores 12 will be cooled. The temperature of these ends of the heat pipes 13, 14, 15, 16 will cool. The thermal energy stored in the rim of the steering wheel will heat the pipes 18 and 19 which will heat the radially outer ends of the pipes 13, 14, 15, 16. The thermal energy will be transferred to the heat exchange block 10, and thus the temperature of the rim of the wheel will drop.

It is to be appreciated, therefore, that when the steering wheel is to be used in a motor vehicle, an electric heater is provided to be received within the chamber 11, and also appropriate air ducting is provided to blow cool air on to the heat exchanger 10, such as air from the air conditioning system of the vehicle.

In the present Specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

## CLAIMS:

1. A steering wheel, the steering wheel comprising a central hub connected by at least one spoke to a rim, the hub containing a heat exchanger element, the heat exchanger element being adapted to be heated and to be cooled, there being at least one heat pipe extending, as part of a spoke, from the heat exchanger to the rim of the steering wheel, there being at least one further heat pipe present within the rim in thermal contact with the heat pipe present in the spoke.
2. A steering wheel having a hub connected by a spoke to a rim, there being a heat exchanger within the hub adapted to be heated and cooled, the heat exchanger being connected to a heat pipe arrangement which extends from the hub to the rim through at least one spoke, and which extends substantially entirely around the rim of the steering wheel.
3. A steering wheel according to Claim 2 wherein the heat pipe arrangement comprises a first heat pipe present in at least one spoke, and at least one further heat pipe present in the rim.
4. A steering wheel according to any one of the preceding Claims wherein there are a plurality of spokes which incorporate heat pipes.
5. A steering wheel according to Claim 4 wherein the steering wheel has a plurality of spokes which each comprise two substantially parallel heat pipes.

6. A steering wheel according to any one of the preceding Claims wherein two heat pipes are provided within the rim, each heat pipe extending substantially half-way round the rim.
7. A steering wheel arrangement according to any one of the preceding Claims in which the or each heat pipe in a spoke is connected to at least one heat pipe in the rim by means of a thermal contact block formed of a material of high thermal conductivity.
8. A steering wheel according to any one of the preceding Claims wherein the heat exchanger is provided with a recess to receive an electric heater.
9. A steering wheel according to any one of the preceding Claims wherein the heat exchanger is provided with a plurality of fins to dissipate heat.
10. A steering wheel substantially as herein described with reference to and as shown in the accompanying drawings.
11. Any novel feature or combination of features disclosed herein.



INVESTOR IN PEOPLE

Application No: GB 0129107.9  
Claims searched: 1

Examiner: Sam Mirison  
Date of search: 26 March 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): F2Y (YSX)

Int Cl (Ed.7): B62D1/06, F28D15/02

Other: online: WPI, EPODOC, JAPIO, FULL-TEXT, INTERNET

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	JP 100230857 (NIPPON OIL) see figures 1 & 2 & abstract.	1,7,9
Y	US 5850741 (FEHER) see particularly figures 1-6.	1,4, 7, 9
Y	US 4640340 (TOYODA; MATSUSHITA) - see eg figure 8.	1,4,7,9
Y	JP 560091189 A (NIPPON ELECTRIC) see Fig. 1-3 & abstract.	1,7
Y	US 4204246 A (SONY),see e.g. figs. 6 & 7.	1,7
A	DE 19951224 A (PETRI), see figures 1-7 & abstract.	
A	JP 620157859 A (EISUKE IMANAGA) see the figures & abstract.	

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.